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Small Area Forecasting with SAM -- THE SPATIAL ALLOCATION MODEL

by Frank Hachman*

Introduction

Large economic developments in non-metropolitan Utah, such as the construction and operation of the Intermountain Power Project in Millard County, oil shale developments in the Uintah Basin, and the possible construction of a nuclear waste repository near Monticello pose considerable challenges for state and local government impact mitigation planners. Of particular interest is how a large project will affect a small rural community or area in terms of both population and employment. For nearly ten years, the Utah Process Economic and Demographic (UPED) model has produced economic and demographic projections for multi-county districts in the state.[1] The UPED projections have been generally well received and, over the decade, have been accorded some forecasting success. However, both state agencies and particularly local governments have understandably found the lack of data for small areas to be a significant deficiency of the model. With the development of the Spatial Allocation Model (SAM) at the Bureau of Economic and Business Research, that deficiency has been partly overcome. The Spatial Allocation Model distributes UPED's regional demographic and

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[1]A description of the UPED Model is available as the document UPED79, by Rodger Weaver, et al., Bureau of Economic and Business Research, University of Utah, January, 1980; or Utah State Planning Coordinator's Office, Salt Lake City, Utah.

Note: Appreciation is expressed to Gayle Taylor, Research Analyst, BEBR, for editorial assistance in preparing this manuscript from the much lengthier presentation in the Association for University Business and Economic Research (AUBER) Readings, Vol. II, 1981.

economic impact projections to subareas in non-metropolitan regions. By providing more detailed information to public and private sector planners and decision makers, SAM broadly expands the utility of the UPED model.

The Spatial Allocation Model grew out of efforts to distribute the small area demographic and economic impacts of alternative federal coal leasing actions.[2] The model, as subsequently developed, is intended for use in the geographically large, sparsely-populated, narrowly-based economies that are typical of Utah's Southwestern, Southeastern, Uintah Basin, and Central Utah Multi-County Districts. It is fully operational and has been used in a variety of impact projection efforts, including impact projections for the construction and operation phases of the MX Missile.[3]

Operational Basis

The feature of UPED serving as the foundation of the Spatial Allocation Model is its production of employment projections that are disaggregated into the categories of "basic" and "residentiary." Basic employment produces goods or services that are directly or indirectly exported to households or firms outside of the region, while the output of residentiary employment is consumed within the region.

For most establishments in the manufacturing sectors, classifying employment into basic and residentiary categories is a relatively uncomplicated matter. The four-digit SIC classification will often suffice for determining a firm's economic role, and if necessary, a telephone call can clarify any possible ambiguity. Allocating basic and residentiary employment in the transportation, communication, utilities, trade, finance, service, and government sectors, however, presents more of a challenge than allocating manufacturing employment. Location quotients and minimum requirement studies are used, along with specific studies such as estimates of contributions of travel and tourism to the regional economic base and a 1972 input-Output table for the state.

The Logic of SAM

SAM is a system of equations developed around an elementary solution condition and a crucial, simplifying assumption. The solution condition is that of equality in each subarea between the employed labor force and the number of jobs. The equations express the employed labor force in a subarea as possibly being a function of commuting among subareas, while the number of jobs in a subarea depends in part on the population of other subareas and the geographical patterns of trade in residentiary services. The crucial, simplifying assumption is that of independence between the per capita job requirements for residentiary services, and both the geographical location of employment and the subarea of residence of the population being served.

The equality among subareas in the sector specific ratio of employment per capita in the provision of residentiary services is subject to aggregation errors and reporting problems. For example, medical services employment in a Census County Division (CCD) with a proprietorship dentist and no practicing MD would display a different ratio of employment per unit of service than a CCD with an incorporated group of physicians. But, to

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[2] These projections were produced for the Uintah-Southwestern Utah Coal Region Environmental Impact Statement, Bureau of Land Management, U.S. Department of the Interior.

[3] Economic and Demographic Impacts of MX Deployment in Utah and Nevada, Part A--Permanent Operations Phase, Part B--Construction Phase, (produced under contract to the Utah State Planning Coordinator's Office for MX Local Oversight Committees), Bureau of Economic and Business Research, Graduate School of Business, University of Utah, Salt Lake City, Utah, February 1981.

the extent that these sources of errors are likely to become important only with higher order services, the sense of the model is not imperiled by its application to non-metropolitan regions with few higher order service centers.

The assumption of equality across subareas in the number of residentiary jobs per capita demanded by the population is less restrictive to applications of SAM in non-metropolitan regions than in metropolitan modeling. A metropolitan region exhibits wide variations among subareas in the incomes, tastes, and demographic composition of households. However, in sparsely populated non-metropolitan regions, it is less unreasonable to expect, for instance, that the same per capita elementary school employment would be demanded in two different counties.

A more immediate justification for the simplifying assumptions arises from the frequent application of SAM to the difference between two regional projections. In practice, a defined event or combination of events in the economic base will have been projected to induce regional population and residentiary employment impacts with the impact population having a composition generated by the age and sex specific migration assumption of the regional projection (UPED) model. For population expanding events, the allocation of similarly composed incremental populations among subareas is consistent with the operation of the UPED model. Furthermore, when the impact projections are of large projects, the construction and operation phases are typically projected as two different events. Hence, the assumption that the incomes and tastes of households and the prices faced by them are independent of the subarea of settlement is not unrealistic for impact households as it would be for the indigenous population.

The Components of SAM

The per capita service ratio for each sector of employment is the regional projection of residentiary employment impact divided by the total impact population. Symbolically, this employment is designed as "RSI_j (for Residentiary, Spatially Interactive Employment of the j^{th} industry) and the entire region's projected impact population as shown as "POPT." The regional population-serving employment of industry j associated with the population of the i^{th} area is $APOP_i x(RSI_j \div POPT)$ where "$APOP_i$ stands for the population allocated to the i^{th} area. Of course, $APOP_i$, for all i, is to be solved for by SAM.

The relationship between the population of one area i, and the location by area of residentiary employment serving that population is given by the elements of a "SPINT" (for SPatial INTeraction) matrix. The element in the r^{th} row and c^{th} column of this matrix for the j^{th} industry, $s_{j,r,c}$, states area r's proportion of the residentiary employment in industry j serving the population of area c. Producing the number $s_{j,r,c}$ for every j, r, and c is the major calibration task in applying SAM. The techniques used to calibrate the SPINTS will be discussed briefly in the closing section.

The total residentiary employment to be located in any area r is given algebraically as:

$$\sum_j \sum_c s_{j,r,c} x\{APOP_c x(RSI_j \div POPT)\}.$$

Or, with APOP being the column vector of $APOP_1$,s, the vector of residentiary employment by area is:

$$\sum_j SPINT_j * (APOP)\{RSI_j \div POPT\}.$$

The total number of jobs located in area r is the sum of this residentiary employment and the basic employment located in the area. The basic employment of the impacting event is usually specified in location because of resource endowments or stipulated developer decisions. Because the location is not necessarily dependent on the spatial allocation of the existing population, it is designated as "$BGNI_{ji}$" for "Basic Employment, Geographically Non-Interactive" of industry j located in area i. The sum over i of $BGNI_{ji}$ is equal to the regional projection model's output of basic employment in the region for industry j and is produced by an initial calibration task of geographically assigning from project descriptions both the direct and indirect basic employment.

The area of residence of workers is not necessarily the same as the area of location of jobs. The elements of the industry specific "COMMUT" matrices incorporate commuting patterns into SAM with element $c_{j,r,c}$ of $COMMUT_j$ stating for the j^{th} industry the proportion of the jobs in area c held by workers commuting from area r. The COMMUT matrix for an industrial sector where all workers reside in the same subarea as their employment is the identity matrix of an order equal to the number of subareas in the projection region.

The specification of elements in the COMMUT matrix is the remaining calibration task in using SAM. In several applications the project description establishes the commuting assumptions for the direct basic employment.[4] In other applications, local planners have been willing to express their opinions as to the current and expected commuting patterns.

Presenting $APOP_i$ and $BGNI_{ji}$ for all subareas i, as column vectors APOP and $BGNI_j$ permits the algebraic representation of residence of all workers as:

$$W = \sum_j COMMUT_j * BGNI_j + \sum_j COMMUT_j * SPINT_j * APOP * (RSI_j \div POPT)$$

where W is the column vector of workers by place of residence given the vector of population, APOP.

The number of workers produced by the impact population in a subarea "i" is the allocated population of the subarea multiplied by the regional Job Holding Rate or $APOP_i$ x JHR where JHR is equal to the projected total impact employment divided by POPT. This uniformity of the job holding rate across subareas is a consequence of assuming homogeneity among subareas in impact populations. This simplifying assumption reduces SAM to a

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[4] In one interesting application, different commuting assumptions for three classes of construction workers were exogenously specified as policy options in MX construction scenarios for calculating the alternative impacts on population and local service expenditure requirements at the sub-county levels. The alternative SAM allocations were prepared in April 1981 for Energy and Resource Consultants, Inc. of Boulder, Colorado, in support of that firm's contract work for the International Security and Commerce Program of the Office of Technology Assessment of the U.S. Congress.

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system of linear equations but is not an assumption necessary to a solution of the model. If there are grounds for specifying subarea specific job holding rates, JHR_j, then the i^{th} element of the column vector of workers, W, given the regionally allocated population is $W_i = JHR_i \times APOP_i$. This has a useful matrix representative of J * APOP where J is an n x n matrix with the i^{th} diagonal element being JHR_i and zeros for all other elements and APOP is the column vector of subarea populations.

The column vector W as a number of job holders by subarea is given as:

(1) $W = J*APOP.$

Then, as the jobs held by the subarea populations was given earlier by

(2) $$W = \sum_j COMMUT_j*BGNI_j + \sum_j COMMUT_j*SPINT_j*APOP*(RSI_j \div POPT)$$

the solution condition is

(3) $$J*APOP = \sum_j COMMUT_j*BNGI_j + \sum_j COMMUT_j*SPINT_j*APOP*(RSI_j \div (POPT).$$

If $JHR_i = JHR_j$ for all i and j, (the homogeneity assumption) then (3) can be directly solved for the vector APOP as the product of the matrix

$$[J - \sum_j COMMUT_j*SPINT_j*(RSI_j \div POPT)]^{-1}$$

and the vector $\sum_j COMMUT_j*BGNI_j$.

If $JHR_i \neq JHR_j$ for some i and j then the solution vector is generated through iterations adjusting the JHR_i matrix by a scalar α such that JHR_i relatives among subareas are preserved and the population weighted average of subarea employment is equal to regional total employment. The successive α's are produced with

$$\alpha'' = \frac{\sum_j \sum_i BGNI_{ij} + \sum_j RSI_j}{\sum_i \left(\frac{APOP'_i}{POPT}\right) JHR_i}$$

where APOP' equals the product of the matrix

$$[\alpha'J - \sum_j COMMUT_j*SPINT_j*(RSI_j \div POPT)]^{-1}$$

and the vector $\sum_j COMMUT_j*BGNI_j$.

This process was used in the 33 subarea MX study with three to five iterations being sufficient to produce negligible changes in all $APOP_i$'s.

An Example of a SAM Allocation

A recent BEBR study produced in association with the Office of the State Planning Coordinator provides illustrations of the inputs to SAM and the character of resulting output.[5] The Uintah Basin region of Utah contains several of the possible oil shale and tar sands synfuels projects and is also the location of a large steam generation project with an associated coal mine. Among the separately analyzed events, the power plant is a convenient illustration of SAM applied to the regional impact projection.

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[5] Energy Development in the Uintah Basin: Economic and Demographic Impacts, jointly produced by the Bureau of Economic and Business Research and the Office of the State Planning Coordinator, July, 1981, and condensed in Utah Economic and Business Review, Volume 41, Number 10, October, 1981.

For the Uintah Basin MCD plus Rangely, Colorado, the UPED model generated a population impact of 2,637 and an employment impact of 1,286 in the year 1986 from the projected coal mine near Rangely, Colorado and the generating station in an unpopulated region (Bonanza) of Uintah County, Utah. The coal mining and coal transportation basic employment of 572 is assigned to the mine site near Rangely with an expressed assumption of no long distance commuting to the permanent mine jobs. The power plant is described by the developers as having 200 jobs of which all will be held by workers commuting from other regions. Consultants to the Uintah Basin Association of Governments specified commuting proportions to the plant of 0.126 from the Roosevelt subarea of Duchesne County, 0.80 from the CCD of Vernal, 0.014 from the Uintah-Ouray subarea of Uintah County, and 0.06 from the Rangely, Colorado community. The task expected of SAM was the simultaneous allocations of the incremental residents and residentiary jobs with no changes in existing trading patterns and no other commuting than that described for the power plant.

Table 1 shows the UPED employment data by sector for the year 1986 for the Uintah Basin as a whole. Table 2 presents the employment impacts assigned by SAM to the Vernal subarea. The detail shown in Table 2 provides the analyst with a detailed presentation of the results produced by the specified COMMUT and SPINT matrices. In Table 2 for example, sector 15 "Retail" displays zero impact basic employment in the Vernal subarea. That is, the 5th element in the vector $BGNI_{15}$ is zero. Residentiary employment in the Vernal subarea associated with providing retail services to the impact population is 45.37 and is found as the 5th element in the vector: $SPINT_{15}*\{RSI_{15} \div POPT\}*(APOP)$. Total retail employment in the subarea is the sum of the basic retail and the regionally residentiary retail but does not necessarily equal Vernal area residents employed in sector 15. The job holding by residents for this sector is the 5th element in the vector produced by postmultiplying the matrix

$COMMUT_{15}$ by

$[\hat{}PINT_{15}*\{RSI_{15} \div POPT\}*APOP+BGNI_{15}]$.

Here, because $COMMUT_{15}$ is the identity matrix, the resident jobs held in retail are the subarea's retail employment. The column "RSEREL" is the subarea's Residentiary Service Employment RELatives by sector. For sector 15 employment, Vernal's 45.37 residentiary impact for 715.77 more people is 1.448 times as much as the region's 116 residentiary retail jobs for the increment of 2,637 people.

The column labeled "Domestic Requirement" is the residentiary service requirement of the Vernal impact population at the regional rate of service provision, 715.77 x (116 ÷ 2,637) for sector 15. Of Vernal's "Domestic Requirement" in sector 15 of 31.32 jobs, Vernal supplies to itself 30.67 as the product of element 5,5 of $SPINT_{15}$, (0.979137), and 31.32. This then implies that (1-.979137) or .020863 times 31.32 is Vernal's sector 15 residentiary requirement provided by the other seven subareas in the region while 45.37 less 30.67 or 14.70 jobs is the total sector 15 job equivalent of residentiary services provided by the Vernal subarea to the other seven subareas. The difference between the import of services of .020863 x 32.31 and the export of 14.70 is the job equivalent of the intra-regional net export of Vernal's sector 15 impact employment.

Improved availability and quality of small-area employment and income data and their accumulation into time series of considerable duration are obviously of importance to the Spatial Allocation Model. However, for the conveniently simple and currently calibrated regions where significant events are to be projected, the UPED-SAM combination yields reasonable impact projections with low turn-around time and very little expense.

Table 1

UTAH PROCESS ECONOMIC AND DEMOGRAPHIC PROJECTIONS
Uintah Basin MCD Plus Rangely, Colorado
Moon Lake Power Plant and Coal Mine-Operations Impact
Detailed Industry Employment Projections -- 66 Sectors, 1986

Industry Sector	Total Employment	Basic Employment	Residentiary Employment
(1) Agriculture	0	0	0
(2) Agriculture Services	0	0	0
(3) Coal Mining	573	572	1
(4) Petroleum and Natural Gas Mining	0	0	0
(5) Metal Mining	0	0	0
(6) Non-Metal Non-Fuel Mining	0	0	0
(7) General Building Contractors	11	0	11
(8) Heavy Construction	16	0	16
(9) Special Trade Construction	15	0	15
(10) Food Manufacturing	3	0	3
(11) Textile and Apparel	0	0	0
(12) Printing and Publishing	2	0	2
(13) Chemicals	0	0	0
(14) Lumber and Furniture	0	0	0
(15) Machinery Except Electrical	0	0	0
(16) Electrical Machinery	0	0	0
(17) Transportation Equipment	0	0	0
(18) Petroleum Refining	0	0	0
(19) Primary Metals	0	0	0
(20) Fabricated Metals	0	0	0
(21) Stone, Clay and Glass	3	0	3
(22) Miscellaneous & Other Manufacturing	0	0	0
(23) Railroad Transportation	0	0	0
(24) Motor Freight and Warehouse	0	0	0
(25) Local Suburban	0	0	0
(26) Air Transport	1	0	1
(27) Pipeline and Water	0	0	0
(28) Transport Services	0	0	0
(29) Communications	7	0	7
(30) Electrical Gas & Sanitation Services	207	200	7

Table 1 (continued)

Industry Sector	Total Employment	Basic Employment	Residentiary Employment
(31) Wholesale Trade	11	0	11
(32) Eating and Drinking, Retail	36	0	36
(33) Building Materials, Farm Equipment	4	0	4
(34) General Merchandise	15	0	15
(35) Food Stores	19	0	19
(36) Auto Dealers and Service Stations	25	0	25
(37) Apparel	3	0	3
(38) Furniture	2	0	2
(39) Miscellaneous Retail	12	0	12
(40) Banks and Other Credit	12	0	12
(41) Insurance	1	0	1
(42) Securities and Investment	0	0	0
(43) Real Estate	3	0	3
(44) Hotels and Lodging	0	0	0
(45) Personal Services	7	0	7
(46) Business Services	5	0	5
(47) Auto Repair	1	0	1
(48) Miscellaneous Repair	3	0	3
(49) Amusement and Recreation	6	0	6
(50) Private Household	4	0	4
(51) Medical and Health Exc. Hospitals	7	0	7
(52) Hospitals	28	0	28
(53) Legal Services	0	0	0
(54) Private Education	3	0	3
(55) Non-Profit and Museums	16	0	16
(56) Miscellaneous Professional Services	2	0	2
(57) Federal Public Administration	10	0	10
(58) Federal Military	0	0	0
(59) Post Office and Services	4	0	4
(60) State Public Administration	13	0	13
(61) State School	12	0	12
(62) State Trade and Services	4	0	4
(63) Local Public Administration	37	0	37
(64) Local School	84	0	84
(65) Local Utilities and Services	0	0	0
(66) Non-Farm Proprietors	52	0	52
Total	1,286	772	514

Source: Bureau of Economic and Business Research, University of Utah.

Table 2

IMPACT EMPLOYMENT DATA BY SECTOR FOR YEAR 1986, VERNAL SUBAREA
Uintah Basin MCD Plus Rangely, Colorado
Moon Lake Power Plant and Coal Mine Operations Impact

Impact Population, 715.77

Sector	Basic Employment	Residentiary Employment	Total Employment	Jobs Held by Residents	RSEREL	Domestic Requirement	Own Provision	Net Export
1 Agricultural/Services	.00	.00	.00	.00	.000	.00	.00	.00
2 Metal and Fuel Mines	.00	.59	.59	.59	2.781	.21	.21	.38
3 No-Metal No-Fuel	.00	.01	.01	.01	1.172	.01	.01	.00
4 Construction	.00	12.39	12.39	12.39	1.121	11.05	10.66	1.34
5 Food Manufacturing	.00	1.78	1.78	1.78	1.974	.90	.88	.88
6 Printing and Publishing	.00	1.85	1.85	1.85	2.806	.66	.64	1.19
7 Stone, Clay, Glass	.00	.00	.00	.00	.000	.75	.00	-.75
8 Other Manufacturing	.00	.22	.22	.22	1.396	.15	.15	.06
9 Railroad Transportation	.00	.00	.00	.00	.000	.00	.00	.00
10 Freight and Warehouse	.00	1.98	1.98	1.98	1.222	1.62	1.60	.36
11 Local Suburban	.00	.00	.00	.00	.000	.00	.00	.00
12 Air Trans. and Trans. Serv.	.00	.69	.69	.69	3.583	.19	.19	.50
13 Private Utility	.00	5.56	5.56	165.56	1.466	3.79	3.75	1.77
14 Wholesale Trade	.00	5.20	5.20	5.20	1.679	3.10	3.03	2.10
15 Retail	.00	45.37	45.37	45.37	1.448	31.32	30.67	14.05
16 FIRE[a]	.00	5.56	5.56	5.56	1.227	4.53	4.42	1.03
17 Hotels and Gaming	.00	.00	.00	.00	.000	.00	.00	.00
18 Professional and Other Services	.00	23.36	23.36	23.36	1.884	12.40	12.31	10.96
19 Hospital and Medical	.00	9.46	9.46	9.46	.992	9.53	8.68	-.07
20 Private Education	.00	2.81	2.81	2.81	3.648	.77	.77	2.04
21 Federal Public Administration	.00	5.15	5.15	5.15	1.424	3.61	3.55	1.51
22 Federal Military	.00	.00	.00	.00	.000	.00	.00	.00
23 State Public Administration	.00	13.11	13.11	13.11	2.878	4.70	4.61	8.40
24 State School	.00	3.29	3.29	3.29	1.000	3.29	3.29	.00
25 Local Public Administration	.00	11.75	11.75	11.75	1.179	9.97	9.84	1.78
26 Local School	.00	22.88	22.88	22.88	.000	22.81	22.81	.07
27 Non-Farm Proprietors	.00	15.97	15.97	15.97	.000	14.05	13.46	1.92
Totals	.00	188.98	188.98	348.98		139.44	135.55	49.55

[a]Fire, Insurance, Real Estate.

Source: Bureau of Economic and Business Research, University of Utah, Salt Lake City, Utah.

Utah Business Statistics

STATEWIDE STATISTICAL DATA	Nov. 1981	Oct. 1981	Nov. 1980	% Change From Year Ago	12 Month Average Nov. 1981	12 Month Average Nov. 1980	% Chg.
Agriculture							
Cash Receipts from Farm Marketing (thous. of dol.)	52,659	49,783	50,828	3.6	na	na	na
Livestock and Livestock Products (thous. of dol.)	37,132	33,253	37,346	-0.6	na	na	na
Crops (thous. of dol.)	15,527	16,530	13,482	15.2	na	na	na
Avg. Prices Rec'd by Farmers (15th of each mo.)(dol.):							
Beef Steers and Heifers (cwt)(thou.)	56.3	56.6	63.7	-11.6	60.1	65.3	-7.7
Lambs (cwt)	41.2	46.9	56.8	-27.5	54.2	61.5	-11.9
Turkeys (per lb.)	.40	.35	.56	-28.6	na	na	na
Milk, Wholesale (cwt)	13.6	13.5	13.4	1.5	13.4	12.7	5.5
Alfalfa Hay, Baled (per ton)	65.0	61.0	69.5	-6.5	68.1	67.1	1.5
Livestock Slaughtered (live weight):							
Cattle (thous. of lbs)	20,109.5	20,326.9	17,186	17.0	18,642.4	17,357.8	7.4
Sheep and Lambs (thous. of lbs.)	244.2	264.5	257	-5.0	218.7	229.5	-4.7
Hogs and Pigs (thous. of lbs.)	3,422	3,618	2,870	19.2	3,346.8	2,927	14.3
Finance							
Loans, Total, Utah Member Banks (mil. of dol.)[a]	3,556	3,295	3,104	14.6	3,292.6	3,165	4.0
Investments, Total, Utah Member Banks (mil. of dol.)[a]	954	953	948	0.6	937.2	860.3	8.9
Deposits, Total, Utah Member Banks (mil. of dol.)[a]	4,309	4,077	4,000	7.7	4,074.9	3,923.2	3.9
Demand Deposits of Banks, Total, Utah (mil. of dol.)[a]	76	56	69	10.1	62.4	59.7	4.5
Other Demand Deposits, Total, Utah (mil. of dol.)[a]	1,091	1,021	1,303	-16.1	1,083.8	1,213.2	-10.7
Time Deposits, Total, Utah (mil. of dol.)	3,140	2,996	2,627	19.5	2,985.1	2,650.8	12.6
Savings, Savings and Loan Association (mil. of dol.)[b]	1,680.1	1,696.6	1,731.8	-3.0	na	1,708.7	na
New Corporation (no.)	440	510	405	8.7	512.5	423.7	21.0
Tax Collections by the State of Utah (thous. of dol.)[r]							
Total Tax Collections	161,910.3	41,985.6	130,879.1	25.2	82,428.0	71,889.4	14.6
Sales & Use Tax	85,261.9	8,618.2	68,442.9	24.6	31,049.6	5,062.9	513.3
Motor Fuel Tax	1,547.2	5,749.6	1,007.4	53.6	5,062.9	4,478.9	13.0
Individual Income Tax	68,466.8	15,476.5	48,577.4	25.6	26,992.2	23,038.8	17.1
Corporation Franchise Tax	411.1	1,847.3	278.9	47.4	1,360.9	1,357.2	0.1
Employment							
Civilian Labor Force (thous.)[c]	635.2	635.5	622.2	2.0	641.4	618.3	3.7
Total Employed Persons	598.9	602.3	587.7	1.9	608.5	585.5	3.9
Unemployed	36.1	33.2	34.7	4.6	38.2	32.8	16.5
Percent Total Labor Force	5.7	5.2	5.6	1.8	6.1	5.2	17.3
Employees on Nonagricultural Payrolls (thous. of jobs)	569.3	567.9	557.8	2.0	571.9	550.9	3.8
Manufacturing	90.9	91.1	88.0	3.3	93.6	87.9	6.5
Mining	21.5	21.4	19.8	8.6	19.1	18.3	4.4
Contract Construction	30.0	30.1	32.7	-8.3	32.1	31.9	0.6
Transportation, Communication and Utilities	35.0	35.2	33.7	3.9	35.7	34.1	4.7
Wholesale Trade	35.9	35.9	34.5	4.0	37.4	34.0	10.0
Retail Trade	97.9	96.3	96.9	1.0	100.0	94.7	5.6
Finance, Insurance and Real Estate[d]	26.1	26.4	25.9	1.9	26.9	25.8	4.3
Services	105.2	106.0	100.6	4.6	106.6	99.2	7.5
Federal Government	36.5	36.6	36.1	1.1	37.9	37.0	2.4
State Government[e]	33.1	32.6	33.0	0.3	33.6	32.2	4.3
Local Government[e]	56.9	56.3	56.6	0.5	56.6	55.6	1.8
Average Weekly Hours							
Manufacturing	40.1	39.9	39.7	1.0	39.6	39.1	1.3
Mining	44.1	43.3	43.2	2.1	42.4	40.9	3.7
Contract Construction	39.0	39.5	36.2	7.7	38.3	36.6	4.6
Wholesale Trade	37.9	36.3	37.5	1.1	36.7	37.3	-1.6
Retail Trade	28.1	28.4	26.8	4.9	28.1	27.6	1.8
Amount of Unemployment Comp. (thous. of dol.)	5,733.5	5,965.3	4,909.6	16.8	6,675.1	5,696.8	17.2
Construction							
Total Construction (thous. of dol.)	104,700	116,100	106,100	-1.3	99,481.6	88,590.5	12.3
Residential	30,200	31,200	36,100	-16.3	30,367.8	35,844.2	40.5
Nonresidential	62,600	68,600	69,600	-10.2	57,958.1	41,830.6	-13.4
Public Works and Utilities	9,900	16,400	300	2,900	11,175.4	10,921.3	2.3
Total Permit Construction (thous. of dol.)[f]	83,498.7	78,371.3	87,041.4	-4.2	80,128.7	76,580.7	4.6
Residential	25,892.5	29,189.9	40,681.7	-36.3	31,377.9	33,747.7	-7.0
Nonresidential	31,960.0	28,078.0	29,459.2	-19.0	33,831.9	35,241.6	-4.0
Additions, Alterations and Repairs	25,357.1	21,123.4	6,900.5	60.8	8,491.4	7,590.9	11.9
New Dwelling Units (no.)	532	707	1,165	-55.2	816.8	875.7	-6.7
Tourism/Travel							
Air Passengers (total no. on and off)	297,734	323,895	277,166	7.4	334,043.1	358,701.9	-6.9
Highway Traffic Count Across State Lines	37,285	47,867	34,537	8.0	na	na	na
Transient Room Taxes (thous. of dol.)	718.9	85.1	555.5	29.4	na	na	na
Visits, State, Nat'l. Parks, Monuments (thous.)	332.9	671.4	355.1	-6.2	1,017.9	988.8	2.9
General							
New Cars and Truck Sales	3,931	5,141	na	na	na	na	na
C.P.I. (National Index -- 1967 = 100)	280.7	279.4	256.2	9.6	299.8	243.9	22.9
Telephones in Service. (Business)	77,280	77,863	77,229	0.1	77,352.6	76,425.4	1.2
Telephones in Service. (Residential)	428,800	429,700	417,398	2.7	424,430.3	409,778.5	3.6
Electric Customers (Commercial)	56,384	56,134	54,543	5.1	na	na	na
Electric Customers (Residential)	389,891	388,981	378,534	3.0	na	na	na
Natural Gas Customers (Residential & Commercial)	389,209	383,761	378,530	2.8	382,970.5	373,692.6	2.5
Natural Gas Customers (Industrial)	554	555	607	-8.7	564.2	603.0	-6.4
Production							
Net Electric Power Utilized (mil. of kwh)	1,018.6	1,032.6	1,102.5	-7.6	1,120.0	1,018.7	9.9
Crude Oil to Refineries (thous. of bbls.)	4,239.4	4,360.7	4,337.9	-2.3	4,348.5	4,190.9	3.8
Crude Oil Production (thous. of bbls.)	na	na	na	na	na	na	na
Natural Gas Production (mil. of cu. ft.)	na	na	na	na	na	na	na
Coal (thous. short tons)	698	742	788	-11.4	928.8	871.6	6.6
Copper (thous. metric tons)[g]	17,436	19,195	16,115	8.2	17,307.8	13,176.9	31.3

Utah Business Statistics

MULTI-COUNTY PLANNING DISTRICT STATISTICAL DATA	Nov. 1981	Oct. 1981	Nov. 1980	% Change From Year Ago	12 Month Average Nov. 1981	12 Month Average Nov. 1980	% Chg.
Wasatch Front (Salt Lake, Tooele, Davis, Weber, Morgan							
Non-Ag. Employment (thous.)	400.1	399.4	392.2	2.0	408.8	391.3	4.5
Auth. Permit Construction (Mil. of dol.)	34.7	37.3	58.8	-41.0	43.3	41.9	3.3
New Dwelling Units	217	444	800	-72.9	394.6	504.8	-21.8
Postal Receipts (thous.)[h]	12,376.8	5,135.1	9,086.5	36.2	5,314.9	4,418.5	20.3
Electric Customers (Residential)	280,679	279,823	274,586	2.2	277,068.7	270,322.9	2.5
Electric Customers (Commercial)	22,705	22,565	22,105	2.7	22,406.6	21,429.2	4.6
Natural Gas Customers (Residential)	287,330	283,576	280,717	2.4	282,954.2	277,413.8	2.0
Natural Gas Customers (Industrial)	407	407	447	-8.9	416.0	444.9	-6.5
Department Store Sales (mil. of dol.)	46,361	39,930	45,070	2.9	40,438.6	35,014.2	15.5
Salt Lake City							
Non-Ag. Employment (Salt Lake and Tooele)(thous.)	304.2	304.5	297.9	2.1	311.3	296.5	5.0
Auth. Permit Construction (mil. of dol.)	11.6	9.4	24.7	-53.0	12.6	11.8	6.8
New Dwelling Units	12	13	12	0.0	5.0	49.2	-89.8
Postal Receipts (thous.)[h]	9,641.7	4,214.8	7,398.5	30.3	4,235.3	3,603.6	17.5
Natural Gas Customers (Residential)	57,021	56,313	57,063	-0.07	55,695.4	57,039.1	-2.4
Natural Gas Customers (Industrial)	148	147	169	-12.4	155.0	165.3	-6.2
Telephones in Service (Business)[i]	40,959	41,636	42,139	-2.8	41,634.4	42,160.3	-1.2
Telephones in Service (Residential)[i]	217,242	217,048	212,544	2.2	214,757.0	209,954.2	2.3
Ogden							
Non-Ag. Employment (Weber, Morgan, Davis)(thous.)	95.8	95.9	94.3	1.6	97.9	94.9	3.2
Auth. Permit Construction (mil. of dol.)	1.8	1.9	1.2	50.0	4.6	3.6	27.8
New Dwelling Units	25	6	7	257.1	21.4	18.8	13.8
Postal Receipts[h]	845.9	376.1	677.7	24.8	403.5	341.7	18.1
Natural Gas Customers (Residential)	22,280	21,804	21,812	2.1	22,110.3	21,667.9	2.0
Natural Gas Customers (Industrial)	52	52	58	-10.3	52.7	58.9	-10.5
Telephones in Service (Business)[j]	7,125	7,121	7,072	0.7	7,063.6	6,957.3	1.5
Telephones in Service (Residential)[j]	43,773	43,775	43,178	1.4	43,503.2	42,725.4	1.8
Mountainland (Utah, Wasatch, Summit Counties)							
Non-Ag. Employment (thous.)	73.7	72.4	72.0	2.4	72.9	70.7	3.1
Auth. Permit Construction (mil. of dol.)*	15.6	18.3	10.9	43.1	16.6	15.3	8.5
New Dwelling Units	120	89	125	-4.0	163.1	150.0	8.7
Postal Receipts (thous.)[h]	1,495.7	651.7	1,149.5	30.1	699.9	566.7	23.5
Electric Customers (Residential)	54,962	53,689	53,370	3.0	na	na	na
Electric Customers (Commercial)	6,027	5,994	5,727	5.2	na	na	na
Natural Gas Customers (Residential)	61,316	60,494	59,158	3.6	60,484.6	58,448.8	3.5
Natural Gas Customers (Industrial)	81	81	92	-12.0	81.8	90.9	-10.0
Provo							
Non-Ag. Employment (thous.)(Utah Co.)*	67.3	66.3	65.8	2.3	67.1	64.6	3.9
Auth. Permit Construction (mil. of dol.)*	1.9	1.6	2.4	-20.8	3.1	2.8	10.7
New Dwelling Units	15	11	36	-58.3	37.3	27.4	36.1
Postal Receipts (thous.)[h]	814.8	392.0	655.7	24.3	391.1	312.6	25.1
Natural Gas Customers (Residential)	16,010	15,786	15,579	2.8	16,348.8	15,403.7	6.1
Natural Gas Customers (Industrial)	35	35	40	-12.5	38.3	41.8	-8.4
Telephones in Service (Business)[k]	6,529	6,576	6,336	3.0	6,410.1	6,313.3	1.5
Telephones in Service (Residential)[k]	40,955	40,964	39,842	2.8	39,060.2	38,169.8	2.3
Central Utah (Juab, Millard, Sanpete, Sevier, Piute, Wayne)							
Non-Ag. Employment (thous.)	12.9	12.9	12.6	2.4	12.7	12.7	0.0
Auth. Permit Construction (mil. of dol.)*	1.2	2.5	4.4	-72.7	1.9	7.4	-74.3
New Dwelling Units	15	28	44	-65.9	32.6	37.9	-14.0
Postal Receipts (thous.)[h]	215.2	77.1	124.1	73.4	88.9	68.1	30.5
Electric Customers (Residential)	9,398	9,214	9,083	3.5	9,244.4	8,971.6	3.0
Electric Customers (Commercial)	1,787	1,735	1,706	4.7	1,743.2	1,903.2	-8.4
Uintah Basin (Duchesne, Daggett, Uintah Counties)							
Non-Ag. Employment (thous.)	12.5	12.3	12.1	3.3	11.1	11.1	0.0
Auth. Permit Construction (mil. of dol.)*	6.5	4.2	1.8	261.1	5.5	1.8	205.6
New Dwelling Units	80	64	29	175.9	53.5	25.8	107.4
Postal Receipts (thous.)[h]	na	78.6	148.3			71.1	
Electric Customers (Residential)	5,462	5,357	4,990	9.5	5,221.6	4,887.6	6.8
Electric Customers (Commercial)	789	789	731	7.9	756.0	754.0	0.3
Natural Gas Customers (Residential)	5,006	4,799	4,764	5.1	4,831.6	4,700.0	2.8
Natural Gas Customers (Industrial)	5	5	6	-16.7	4.8	6.6	-27.3
Bear River (Box Elder, Cache, Rich Counties)							
Non-Ag. Employment (thous.)	31.1	33.4	32.6	-4.6	32.0	31.9	0.3
Auth. Permit Construction (mil. of dol.)	2.5	10.9	4.7	-46.8	5.2	4.7	10.6
New Dwelling Units	25	19	75	-66.7	62.6	67.5	-7.3
Postal Receipts (thous.)[h]	530.8	249.4	471.4	12.6	251.5	208.1	20.9
Electric Customers (Residential)	26,056	26,029	25,476	2.3	na	na	na
Electric Customers (Commercial)	3,255	3,253	3,150	3.3	na	na	na
Natural Gas Customers (Residential)	25,683	25,233	24,458	5.0	24,173.8	24,035.2	0.6
Natural Gas Customers (Industrial)	47	48	48	-2.1	45.9	46.7	-1.7
Southeastern (Carbon, Emery, Grand, San Juan Counties)							
Non-Ag. Employment (thous.)	21.2	21.1	20.5	3.4	19.5	19.5	0.0
Auth. Permit Construction (mil. of dol.)*	2.5	2.3	1.8	38.9	3.4	2.1	61.9
New Dwelling Units	36	18	30	20.0	30.4	33.9	-10.3
Postal Receipts (thous.)[h]	146.7	66.1	112.5	30.4	na	na	na
Electric Customers (Residential)	11,553	11,070	11,029	4.7	11,245.8	10,810.1	4.0
Electric Customers (Commercial)	1,463	1,413	1,399	4.6	1,432.7	1,418.5	1.0
Natural Gas Customers (Residential)	9,874	9,640	9,433	4.7	9,628.3	9,095.0	5.9
Natural Gas Customers (Industrial)	14	14	14	0.0	14.1	14.0	0.7
Southwestern (Beaver, Iron, Washington, Garfield, Kane Counties)							
Non-Ag. Employment (thous.)	16.1	16.7	15.9	1.3	16.2	16.2	0.0
Auth. Permit Construction (mil. of dol.)	2.7	2.8	4.5	-40.0	4.5	3.9	15.4
New Dwelling Units	29	45	62	-53.2	81.8	56.4	45.0
Postal Receipts (thous.)[h]	248.5	103.4	186.8	33.0	120.7	98.4	22.7
Electric Customers (Residential)	1,781	1,779	na	na	na	na	na
Electric Customers (Commercial)	358	370	na	na	na	na	na

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BUSINESS STATISTICS
Sources and Footnotes

Sources:

Agriculture farm marketings, livestock slaughter, farm prices: U.S. Department of Agriculture
Loans, Investments, Deposits: Federal Reserve reports
Savings, Savings and Loan Association: Utah savings and loan institutions
New Corporations: Utah Secretary of State
Tax Collections: Utah State Tax Commission
Employment Data: Utah Department of Employment Security
Construction: Dodge Construction Statistics and BEBR
Air Passengers: Salt Lake International Airport, statistics service
Traffic Count: Utah Department of Transportation, Travel Analysis Unit
Visits to State and National Parks and Monuments. U.S. Forest Service; Utah State Parks and Recreation Department
Truck and car sales: Utah Automobile Dealers Registrations Service Company
Telephone, electric, natural gas customers: cooperating Utah utility companies
Net electric power utilized: cooperating Utah power companies
Crude oil to refineries: cooperating Utah oil refineries
Copper production: U.S. Bureau of Mines
Coal production: U.S. Department of Energy
Oil and gas production: State of Utah Division of Oil, Gas and Mining

Footnotes:

*May not add to total due to rounding
[a]End of Period, includes member banks of Federal Reserve System
[b]As of the close of business on last day of the month
[c]Current year—preliminary data; previous year—final figures
[d]Includes nonprofit and religious
[e]Includes public schools and colleges
[f]Total new construction plus additions, alterations and repairs
[g]Beginning January 1979, data reported in metric tons; to convert metric tons to short tons, multiply by 1.10231
[h]Includes amounts for two four-week periods
[i]Includes Salt Lake County and Bountiful
[j]Includes Weber and Morgan Counties
[k]Includes Orem and Springville
[r]Revised
na Not available

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